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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/698,964	10/31/2003	Kenneth O. McElrath	3006.001800/KDG	8810

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EXAMINER	
WILLIAMS, SHERMANDA L	
ART UNIT	**PAPER NUMBER**
1745	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/12/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/698,964	MCELRATH ET AL.	
	Examiner	Art Unit	
	Shermanda L. Williams	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 December 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-17* is/are pending in the application.

4a) Of the above claim(s) *2 and 18-62* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *31 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/31/03 5/23/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

This office Action is responsive to the Amendment After Non-Final Rejection filed 12/21/2006. Claims 1 and 3-17 are pending. Claims 2 and 18-62 have been cancelled.

Priority

1. Applicant's claim for the benefit of a prior-filed application under 35 U.S.C. 119(e) or under 35 U.S.C. 120, 121, or 365(c) is acknowledged.

Information Disclosure Statement

The information disclosure statements (IDS) submitted on 10/31/2003 and 5/23/2005 has been placed in the application file, and the examiner has considered the information referred to therein.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 5, 12, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smalley et al. (US 6,683,783 B1) in view of Kawamura et al. (US 6,706,431 B2). Smalley et al. teaches a method of purifying a mixture comprising single-wall carbon nanotubes (SWNT). The SWNT form a mat or "bucky paper" having a thickness of about 100 microns (col. 14 lines 43-46). The catalyst metal is one or more of the Group VI or VIII transition metal such as chromium, molybdenum platinum,

or ruthenium (col. 7 lines 4-15, col. 23 lines 33-46). Smalley teaches that the SWNT exhibit a high level of conductivity, few defects than multi-wall carbon nanotubes, and are very strong (col. 5 lines 49-56). Smalley also teaches that the SWNT conduct with relatively low resistance (col. 6 lines 4-6). Smalley et al. doesn't explicitly teach the use of the SWNT to form a fuel cell electrode. Kawamura et al. teaches the use of carbon nanotubes in the production of fuel cell electrodes (col. 2 lines 45-50. The electrode produced from the carbon nanotubes is used in a proton exchange membrane fuel cell having 2 electrodes and an electrolyte sandwiched between the electrodes (col. 2, lines 53-57). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the single wall nanotube of Smalley et al. in the production of a fuel cell electrode a such as taught by Kawamura et al. because of their high conductivity with little resistance and strength as taught by Smalley et al.

4. In regards to claims 12 and 17, these are statements of intended use. In claim 12, "...a component in a hydrogen/oxygen proton exchange membrane fuel cell (PEMFC)" has not been given patentable weight. In claim 17, "...a component in a direct methanol fuel cell (DMFC)" has not been given patentable weight. It has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations.

5. Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smalley et al. in view of Kawamura et al. as applied to claim 1 above, and further in

view of Fisher et al. (US 6,203,814). The disclosure of Smalley et al. as modified by Kawamura et al. as discussed above is incorporated herein. Smalley et al. as modified by Kawamura et al. does not teach that the nanotubes are derivatized with a functional group.

Fisher discloses a method of making functionalized nanotubes. The graphitic nanotubes or fullerenes are functionalized by chemical substitution (see Abstract). Fisher teaches the use of a polycarboxylic acid in the process to functionalize the nanotubes (col. 7 lines 32-41). It would have been obvious to one having ordinary skill in the art at the time of the invention to use add a functional such as carboxylic acid to the carbon nanotube structure. The presence of the carboxylic acid aids in linking the nanotubes to form the mat or lattice layout.

6. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smalley et al. view of Kawamura et al. as applied to claim 1 above, and further in view of Satoru et al. (JP 08-031444). The disclosure of Smalley et al. as modified by Kawamura et al. as discussed above is incorporated herein. Smalley et al. as modified by Kawamura et al. does not teach that the catalyst metal comprises platinum and ruthenium.

Satoru discloses an electrochemical cell employing carbon particles (see Abstract). The reference teaches that platinum and other noble metal may be used as the catalyst for the electrode construction. It would have been obvious to one having ordinary skill in the art at the time of the invention to use platinum and ruthenium as the catalyst material to promote the electrochemical reaction with the electrochemical cell. Also, it would have been obvious to one having ordinary skill in the art at the time the

invention was made to use platinum and ruthenium as the catalyst because they are art-recognized equivalents. (See MPEP 2144.07)

7. Claims 7-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smalley et al. in view of Kawamura et al. as applied to claim 1 above, and further in view of Hampden-Smith et al. (US 2003/0198849). The disclosure of Smalley as modified by Kawamura as discussed above is incorporated herein. Smalley et al. as modified by Kawamura et al. does not teach that the catalyst metal is present in an amount less than 400 µg/cm2 of the planar area of carbon nanotubes. Hampden-Smith et al. discloses electrocatalyst powders and energy devices using the electrocatalyst powders. The reference teaches the use of homo- and hetero-fullerene and carbon nanotube based material as an active component in the reduction of oxygen (paragraph 109). Hampden-Smith discloses an electrode structure utilizing platinum as the catalyst and having various surface loading values such as of 0.4 mg Pt/cm^2 (paragraph 417), 0.1 mg Pt/cm^2 (paragraph 417), 0.05 mg Pt/cm^2 (paragraph 416). Hampden-Smith does not explicitly teach an electrode with a surface loading of 0.025 mg Pt/cm^2 or 0.010 mg Pt/cm^2, however the it would have been obvious to one having ordinary skill in the art a the time the invention was made to use the absolute minimum amount of platinum catalyst in the electrode of Smalley et al. in view of Kawamura et al. necessary for proper cell performance. This decreases the total amount catalyst required and therefore reduces cell weight and increases the power density of the fuel cell.

The comparisons discussed in Hampden-Smith evaluate cell performance employing various surface loading values concluded that the cell performance was

virtually identical for a cathode loading of 0.1 mg Pt/cm^2 and a catalyst loading of 0.4 mg Pt/cm^2 (paragraph 415-417).

The courts have held that the determination of optimum values of cause effective variable such as catalyst surface loading values require only ordinary skill in the art. In re Boesch; 205 USPQ 215 (CCPA 1980).

8. Claims 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smalley et al. as applied to claim 1 above, and further in view of Hampden-Smith et al. as discussed above. Hampden-Smith also discloses a membrane electrode assembly (MEA) having a supported active species (platinum electrocatalyst) loading of 0.1 mg/cm^2 and a current density of 150 mA/cm^2 (paragraph 38). Therefore, the electrode provides greater than 150 mA/cm^2 per 100 µg/cm^2 of the area of the carbon nanotubes.

9. As well, Hampden-Smith discloses a membrane electrode assembly having a supported active species (platinum electrocatalyst) loading of 0.1 mg/cm^2 and a current density of 150 mA/cm^2 (paragraph 38). Therefore, the electrode provides greater than 150 mA/cm^2 per 100µg/cm^2 of the area of the carbon nanotubes. Also, the reference teaches that the performance of the MEA is primarily judged by reference to the relationship between the cell potential and the current density (paragraph 279, Figure 10). The reference teaches that it is advantageous to achieve a higher current density at a higher voltage and to maximize cell performance at low platinum loading (paragraph 286).

10. Although the current density is not explicitly stated as greater than 10, 50, or 100 mA/cm^2 per $\mu g/cm^2$, it would have been obvious to one having ordinary skill in the art at the time of the invention to optimize the performance of the MEA. See Claims 66-70 of the prior art. It has been held that discovering an optimum value of a result effective variable involves only routine skill in the art.

Response to Arguments

11. Applicant's arguments with respect to claim 1 have been considered but are moot in view of the new ground(s) of rejection necessitated by amendment.

12. In response to applicant's argument that claims 12 and 17 are not statements of intended use, a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. The claimed invention in the current application is a fuel cell electrode. The prior art fuel cell electrode is capable of performing the intended use.

13. In response to applicant's argument that Fisher does not suggest modification of the carbon nanotubes, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Fisher teaches fibrils as well as nanotubes or

"buckytubes" (see Abstract). Because Smalley et al. teaches SWNT, Kawamaru et al. teaches the use of carbon nanotubes in fuel cell electrodes, and Fisher teaches a method of making functionalized nanotubes, it would have been obvious to one having ordinary skill in the art at the time the invention was made to derivatized the SWNT of Smalley et al. with carboxylic acid such as taught by Fisher et al. in order to permit interaction or linkage of the nanotubes with various substrates to form compositions with unique properties (See col.3 lines 46-56, col. 17 lines 6-26).

14. In response to applicant's argument that Satoru et al. does not suggest the use of a platinum and ruthenium combination as the metal catalyst, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Satoru et al. teaches the use of a metal catalyst that is effective in the dissociate adsorption of hydrogen such as palladium, nickel, platinum. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a noble metal catalyst or a combination of noble metals that are capable of the dissociative adsorption of hydrogen as the catalyst such as taught by Satoru et al. for the electrochemical occlusion of the hydrogen.

15. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies

(i.e., the nanotube diameter) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Conclusion

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shermanda L. Williams whose telephone number is (571) 272-8915. The examiner can normally be reached on Mon.-Thurs. 7 AM - 4:30 PM and alternating Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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SUSY TSANG-FOSTER
PRIMARY EXAMINER